

EO2652 SAMPLE EXAM PROBLEMS

1. The voltage of a wave propagating on a transmission line is given by

$$v(y,t) = 50 \cos(10^9 t - 5y) \text{ mV/m.}$$

- (a) What is the direction of propagation?
- (b) What is the frequency?
- (c) Find the phase velocity, u_p .
- (d) Find the wavelength on the line, λ .
- (e) Find the attenuation constant of the line, α .
- (f) Write this voltage in phasor form.

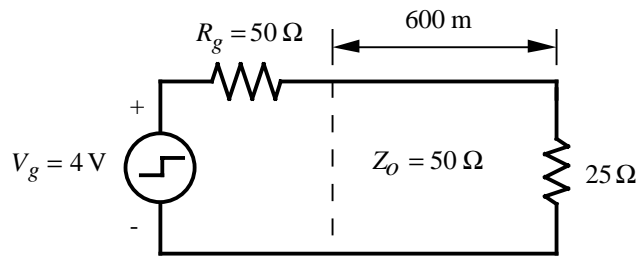
2. Find the phasor representing a leftward travelling wave ($-z$ direction) with amplitude 2 V, frequency 1 GHz, phase velocity 1.5×10^8 m/s, and a phase angle of -30° at $z = 0$.

3. A transmission line has characteristic impedance of 50Ω and carries a sinusoidal wave with amplitude of 1 V moving toward the load (to the right). The load impedance is $Z_L = 50 + j50 \Omega$. Find the power in the reflected wave.

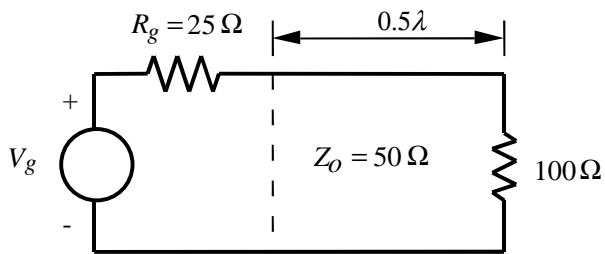
4. A transmission line operates at 50 MHz. The circuit parameters are: $R' = G' = 0$, $L' = 100$ nH/m, and $C' = 225$ pF/m. Find α , β , u_p , and Z_0 .

5. A step voltage is applied to the transmission line circuit shown below. The phase velocity is $u_p = c / 2$.

- (a) Find the reflection coefficients of the load and generator.
- (b) What is the time delay, T , for the wave to travel the length of the transmission line?
- (c) Draw the reflection diagram (bounce diagram). Be sure to completely label the wave amplitudes.
- (d) What is the steady state voltage on the line?



6. For the lossless transmission line circuit shown below find the impedance at the input of the line, the voltage across the input of the line, and the time-averaged power delivered to the load. The voltage is $V_g = 4\cos(\omega t)$.



7. A d-c block is used to prevent d-c and low frequency voltages from passing down the line while allowing transmission of high-frequency voltages. One type uses an open-circuited series stub as shown below.

- What value of Z_{in} is required to pass the microwave signal unattenuated?
- Find stub length to provide the value of Z_{in} you specified in part (a).

